RTCA Special Committee 209

Mode S Transponder MOPS Maintenance

Working Group #1, Meeting #6

Engility Corporation, Washington DC
14 – 16 April 2008

Manufacturers Response and Proposed Changes Related To Action Item WG1-5-1 Rev 1 adds agreed to proposal

Collected and presented by:
Gary Furr
Engility Corporaiton

SUMMARY

This Working Paper collects the response of the respective manufacturers to the request in Action Item WG1-5-1 to review the requirements in draft DO-181D, §2.2.2.4.g and the related test procedure in §2.4.2.1, Step 9 and agree or disagree with the respective requirement and tests.

Introduction:

Action Item WG1-5-1 requested that all manufacturers "**review the addition of the requirement in §2.2.2.4.g and the corresponding test procedure in §2.4.2.1 step 9.**" It was requested that all responses be returned to Gary Furr by COB on 14 March 2008. As of COB on 14 March 2008 responses had been received from the following five (5) manufacturers noted below.

For reference here, the requirement in §2.2.2.4.g and the test procedure in §2.4.2.1, step 9 are repeated as published in version 1.6 of the draft of DO-181D:

§2.2.2.4

g. The spurious ATCRBS reply ratio **shall** not be more than 1% for Mode S interrogations at signal levels above -81 dBm.

§2.4.2.1

Step 9 Spurious ATCRBS Replies to Low Level Mode S Interrogations (§2.2.2.4.g)
Interrogate the transponder with both long and short Mode S interrogations with levels at -81 dBm to MTL +3 dB in 1-dB steps. Verify that the transponder generates no more than 1% spurious ATCRBS replies at each level.

Responses:

Responses were received from the following five (5) manufacturers:

1. **Rockwell Collins, Robert Saffell, Principal Engineer:** agreed with the requirement and test procedure as published.

2. **Becker Avionics, Armin Hettich, Head of R&D:** agreed with the requirement and test procedure as published.

3. **BAE Systems, Raymond Bayh:**
"While we agree that the spurious ATCRBS replies of up to 10% to low level Mode S interrogations at signal levels of -81dBm to MTL +3 dB causes unnecessary interference, we feel that 1% total ATCRBS spurious replies is too tight for today's transponder designs.

BAE Systems proposes that the total ATCRBS spurious replies to low level Mode S interrogations should be no more than 3% total spurious ATCRBS replies at signal levels above -81 dBm.

We propose a revision to the requirement and test procedure step as follows:"

§2.2.2.4:

g. The spurious ATCRBS reply ratio **shall not** be more than 3% for Mode S interrogations at signal levels above -81 dBm.

§2.4.2.1

Step 9 Spurious ATCRBS Replies to Low Level Mode S Interrogations
Interrogate the transponder with both long and short Mode S interrogations with levels at -81 dBm to MTL +3 dB in 1-dB steps. Verify that the transponder generates no more than 3% spurious ATCRBS replies.

4. **Honeywell International, Showkat Osman:**
"Honeywell would like to propose changing the requirement from 1% spurious ATCRBS reply ratio to 2% average spurious ATCRBS reply ratio and allow the reply ratio in the test to average over MTL +3 dB to -81 dBm. Please see the modified text below."

§2.2.2.4:

g. The average spurious ATCRBS reply ratio **shall not** be more than 2% for Mode S interrogations at signal levels above -81 dBm.

§2.4.2.1

Step 9 Spurious ATCRBS Replies to Low Level Mode S Interrogations
Interrogate the transponder with both long and short Mode S interrogations with levels at -81 dBm to MTL +3 dB in 1-dB steps. Verify that the transponder generates no more than 2% spurious ATCRBS replies averaged over MTL+3 dB to -81 dBm.

5. **Garmin International, Van Ruggles and Nolan Van Foeken:**
Garmin proposed the following requirement and test procedure:

§2.2.2.4.g:

g. The spurious ATCRBS reply ratio **shall not** be more than 1% for Mode S interrogations at signal levels above -81 dBm.

§2.4.2.1

Step 9 Spurious ATCRBS Replies to Low Level Mode S Interrogations
Interrogate the transponder with both long and short Mode S interrogations with levels at -81 dBm to MTL +3 dB in 1-dB steps. Verify that the transponder generates no more than 1% spurious ATCRBS replies.

Note: *The Mode S interrogations should contain multiple phase reversal spaced 0.75 µs apart. Two ideal interrogations to meet this criteria would be:*

UF4 with PC=4; RR=12; DI=3; SD=4924; AP=AAAAAA;

UF20 with PC=4; RR=12; DI=3; SD=4924; MA=49249249249249; AP=AAAAAA;

6. **During the SC-209 meeting, and after considerable discussion, the original Garmin suggestion above in "5" was taken and modified to the following. It was agreed by the SC-209 Group that the DO-181D document would be sent to Final Review and Comment (FRAC) with the following requirement and test procedure and that all manufacturers would test their units in order to hold a discussion during the FRAC meeting in June to fill in the blank numbers below.**

§2.2.2.4.g:

g. The spurious ATCRBS reply ratio **shall** be no more than **YY**% from -81 dBm to MTL –**ZZ**, and no more than **AA**% from MTL –**ZZ**+1 to MTL +**XX**.

§2.4.2.1

Step 9 Spurious ATCRBS Replies to Low Level Mode S Interrogations

Interrogate the transponder with both long and short Mode S interrogations with levels at -81 dBm to MTL +**XX** dB in 1-dB steps. At each signal level verify that the transponder generates no more than **YY**% spurious ATCRBS replies from -81 dBm to MTL –**ZZ**, and no more than **AA**% spurious ATCRBS replies from MTL –**ZZ**+1 to MTL +**XX**.

Note: *The Mode S interrogations should contain multiple phase reversal spaced 0.75 µs apart. Two candidate interrogations to meet this criteria would be:*

UF4 with PC=4; RR=12; DI=3; SD=4924; AP=AAAAAA;

UF20 with PC=4; RR=12; DI=3; SD=4924; MA=49249249249249; AP=AAAAAA;